

# *[APPARATUS AND METHOD FOR ADDRESSING BOREHOLE ECCENTRICITY EFFECTS]*

## **Abstract**

A well logging tool apparatus is disclosed for conducting measurements in a borehole environment surrounding a borehole that traverses a subsurface formation. The apparatus includes an elongated conductive mandrel having a longitudinal axis, an antenna array positioned about the mandrel and including a transmitter for transmitting electromagnetic energy into the formation, and a sleeve positioned about the antenna array. The sleeve has an outer surface positioned for exposure to the borehole environment and an inner surface positioned radially inward of the outer surface. The apparatus further includes a first set of electrodes and a second set of electrodes. Each electrode has an outer end and an inner end positioned radially inward of the outer end, and is supported on the sleeve such that the outer end is exposed on the outer surface of the sleeve for conductive contact with an adjacent conductive borehole environment. Further, the first and second sets of electrodes are spaced longitudinally apart such

that the transmitter is positioned longitudinally therebetween (e.g., the first set is positioned above the transmitter while the second set is positioned below the transmitter). Importantly, electrodes of the first and second sets are conductively interconnected with the mandrel such that when the well logging apparatus is operated in a borehole environment having borehole currents therein, one or more current path loops are provided for shorting borehole currents. The current path loops include a first conductive path between the conductive borehole environment, one of the first set of electrodes and the mandrel, and a second conductive path between the conductive borehole environment, an electrode of the second set of electrodes, and the mandrel.